



DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2021-0162; FF09E22000 FXES1113090FEDR 223]

RIN 1018-BF54

Endangered and Threatened Wildlife and Plants; Removal of the Puerto Rican Boa From the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to remove the Puerto Rican boa (*Chilabothrus inornatus*, but listed as *Epicrates inornatus*), an endemic snake from Puerto Rico, from the Federal List of Endangered and Threatened Wildlife (List). This determination is based on the best available scientific and commercial data, which indicate that the species has recovered and the threats to the species have been eliminated or reduced to the point that the species no longer meets the definition of an endangered species or threatened species under the Endangered Species Act of 1973, as amended (Act). If this proposal is finalized, the Puerto Rican boa will be removed from the List and the prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to the species.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date.

We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER

DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: *Written comments:* You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal:

<https://www.regulations.gov>. In the Search box, enter FWS-R4-ES-2021-0162, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, check the Proposed Rule box to locate this document. You may submit a comment by clicking on “Comment.”

(2) *By hard copy:* Submit by U.S. mail to: Public Comments Processing, Attn: FWS-R4-ES-2021-0162, U.S. Fish and Wildlife Service, MS: PRB/3W, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on <https://www.regulations.gov>. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Availability of supporting materials: This proposed rule and supporting documents, including the species status assessment (SSA) report and references cited, the 5-year review, the Recovery Plan, and draft post-delisting monitoring plan are available at <https://www.regulations.gov> under Docket No. FWS-R4-ES-2021-0162 and at the Caribbean Ecological Services Field Office website at <https://www.fws.gov/southeast/caribbean/>.

FOR FURTHER INFORMATION CONTACT: Edwin Muñoz, Field Supervisor, U.S. Fish and Wildlife Service, Caribbean Ecological Services Field Office, P.O. Box 491, Boquerón, PR 00622; email: Caribbean_es@fws.gov; telephone: (787) 405–3641.

Individuals in the United States who are deaf, deafblind, hard of hearing, or have a speech disability may dial 711 (TTY, TDD, or TeleBraille) to access telecommunications relay services. Individuals outside the United States should use the relay services offered within their country to make international calls to the point-of-contact in the United States.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, a species warrants protection through listing if it is endangered or threatened. Conversely, a species may be removed from the List if the Act's protections are determined to be no longer required because the species is extinct, the species does not meet the definition of an endangered or a threatened species (because of, for example, recovery), or the listed entity does not meet the statutory definition of a species. We are proposing to remove the Puerto Rican boa from the List due to recovery. Removing a species from the List can be completed only by issuing a rule.

What this document does. This rule proposes to delist the Puerto Rican boa based on its recovery.

The basis for our action. Under the Act, we may determine that a species is an endangered species or a threatened species based on the five factors described in section 4(a)(1) of the Act: The present or threatened destruction, modification, or curtailment of its habitat or range (Factor A); overutilization for commercial, recreational, scientific or educational purposes (Factor B); disease or predation (Factor C); the inadequacy of existing regulatory mechanisms (Factor D); and other natural or humanmade factors affecting its continued existence (Factor E). We must consider the same factors in removing a species from the List (delisting).

Under the Act and our implementing regulations at 50 CFR 424.11, we may delist

a species if the best available scientific and commercial data indicate that: (1) The species is extinct; (2) the species does not meet the definition of an endangered species or a threatened species when considering the five factors listed above; or (3) the listed entity does not meet the statutory definition of a species. Here, we have determined that the Puerto Rican boa should be proposed for delisting under the Act because, based on an analysis of the five listing factors, it has recovered and no longer meets the definition of an endangered species or a threatened species.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other concerned governmental agencies, Native American Tribes, the scientific community, industry, or any other interested parties concerning this proposed rule.

We particularly seek comments concerning:

- (1) Reasons we should or should not delist the Puerto Rican boa;
- (2) New information on the historical and current status, range, distribution, and population size of the Puerto Rican boa;
- (3) New information on the known and potential threats to the Puerto Rican boa, including development and habitat loss, nonnative snakes and other nonnative species, and diseases;
- (4) New information regarding the life history, ecology, and habitat use of the Puerto Rican boa;
- (5) The extent of protection and management that would be provided by the Commonwealth of Puerto Rico to the Puerto Rican boa as a delisted species; and
- (6) The draft post-delisting monitoring plan and the methods and approaches detailed in it.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for or opposition to the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made “solely on the basis of the best scientific and commercial data available.”

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via <https://www.regulations.gov>, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on <https://www.regulations.gov>.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on <https://www.regulations.gov>.

Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species should remain listed as endangered, or we may conclude that the species should be reclassified as threatened.

Public Hearing

Section 4(b)(5)(E) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* and local newspapers at least 15 days before the hearing. For the immediate future, we will provide these public hearings using webinars that will be announced on the Service's website, in addition to the *Federal Register*. The use of these virtual public hearings is consistent with our regulations in title 50 of the Code of Federal Regulations (CFR) at § 424.16(c)(3).

Supporting Documents

A species status assessment (SSA) team prepared an SSA report for the Puerto Rican boa. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species. The SSA report and other materials relating to this proposal can be found at <https://www.regulations.gov> under Docket No. FWS-R4-ES-2021-0162, and at the Caribbean Ecological Services Field Office website at <https://www.fws.gov/southeast/caribbean/>.

In accordance with our July 1, 1994, peer review policy (59 FR 34270; July 1, 1994), our August 22, 2016, Director's Memo on the Peer Review Process, and the Office of Management and Budget's December 16, 2004, Final Information Quality Bulletin for Peer Review (revised June 2012), we solicited independent scientific reviews of the information contained in the Puerto Rican boa SSA report. We sent the SSA report to nine independent peer reviewers and received eight responses. The SSA report was

also submitted to our Federal, Commonwealth, and Tribal partners for scientific review. We received review from seven partners. In preparing this proposed rule, we incorporated the results of these reviews, as appropriate, into the final SSA report, which is the foundation for this proposed rule.

Previous Federal Actions

The Puerto Rican boa (as *Epicrates inornatus*) was originally listed as an endangered species on October 13, 1970 (35 FR 16047), under the Endangered Species Conservation Act of 1969, and remained listed with the passage of the Act in 1973. A recovery plan for the Puerto Rican boa was completed on March 27, 1986 (Service 1986, 21 pp.), and modified on September 27, 2019 (Service 2019, 9 pp.). In 1991, we initiated a 5-year review for the Puerto Rican boa (56 FR 56882; November 6, 1991), but we did not formally complete that review. We completed a 5-year status review for the Puerto Rican boa on September 16, 2011 (Service 2011, 26 pp.) and did not recommend to reclassify or delist the Puerto Rican boa due to remaining threats and lack of population data (Service 2011, pp. 16–17).

On August 22, 2016, we announced that we were initiating a 5-year review for the Puerto Rican boa and 13 other Caribbean species, and we requested new information that could have a bearing on the status of the Puerto Rican boa (81 FR 56692). We completed an SSA in 2021 (Service 2021, 66 pp.) to inform the most recent Puerto Rican boa 5-year review. This proposed rule also serves as our 5-year review of the species.

For additional details on previous Federal actions, including recovery actions, go to <https://www.fws.gov/program/endangered-species> and search for the species' profile.

Background

A thorough review of the taxonomy, life history, and ecology of the Puerto Rican boa is presented in the SSA report, version 1.1 (Service 2021, 66 pp.), which is available at <https://www.regulations.gov> under Docket No. FWS-R4-ES-2021-0162 and is

summarized in this proposed rule.

The Puerto Rican boa is a large, semi-arboreal, nocturnal, nonvenomous snake endemic to Puerto Rico with the largest recorded sizes around 2 meters (m) (6.6 feet (ft)) in length (Reagan 1984, p. 121; Wiley 2003, p. 192). Dorsal coloration of the Puerto Rican boa is variable and has been described from tan to reddish brown to very dark brown, with several dark bars or spots along its body; juveniles may have a reddish color (Rivero 1998, p. 432).

The Puerto Rican boa uses both ambush and active foraging modes, eating smaller prey when young and mostly rats as they get larger (Rivero 1998, p. 432; Wiley 2003, p. 190; Henderson and Powell 2009, p. 349). In general, prey items include rats, mice, bats, lizards, birds (including domestic fowl), and frogs, but even land crabs and insect fragments have been found in stomach contents (Rodríguez and Reagan 1984, p. 219; Rodríguez-Durán 1996, entire; Rivero 1998, p. 432; Wiley 2003, p. 190; Henderson and Powell 2009, p. 349; Puente-Rolón 2012, p. 54).

Although the Puerto Rican boa is considered widely distributed, it is not uniformly abundant across the island and has a reported elevation range from sea level to 1,050 m (3,445 ft) (Henderson and Powell 2009, p. 349). Earlier occurrence records for the Puerto Rican boa described its wide distribution, with the species occurring in protected, rural, and developed areas (Pérez-Rivera and Vélez, Jr. 1978, p. 71). Later descriptions of Puerto Rican boa distribution increased the occurrence records for the species' wide distribution (Bird-Picó 1994, p. 33; Rivero 1998, p. 433; Wiley 2003, p. 190). The Puerto Rican boa has been reported in all of the municipalities on the main island of Puerto Rico (Puente-Rolón 2018, pers. comm.; Service 2021, p. 14).

The Puerto Rican boa is considered a habitat generalist (Reynolds et al. 2016, p. 1883) and tolerates a wide variety of habitat types (terrestrial and arboreal) (Tolson and Henderson 1993, p. 45; Joglar 2005, p. 143; Henderson and Powell 2009, p. 349). Cave

systems and their surrounding forests are identified as particularly important for the Puerto Rican boa because of the ecological resources available (i.e., prey, shelter, thermal gradients, and mating opportunities) (Puente-Rolón and Bird-Picó 2004, pp. 349–350).

In general, Puerto Rican boas have smaller home ranges when associated with more productive habitats (e.g., concentrated food resources) like cave ecosystems (Puente-Rolón and Bird-Picó 2004, p. 349; Wunderle et al. 2004, p. 567). In areas where food resources are more dispersed or in lower densities, the Puerto Rican boa needs larger home ranges (Puente-Rolón and Bird-Picó 2004, p. 349; Wunderle et al. 2004, p. 567). However, in urban karst landscapes, such as Fort Buchanan, Puerto Rican boas tend to have intermediate home range sizes that might be due to the scarcity and fragmentation of suitable habitat and the presence of artificial barriers like roads (Mulero-Oliveras 2019, p. 33).

Although the actual life span of Puerto Rican boas in the wild is unknown, they may live between 20 and 30 years (Rivero 1998, p. 433; Henderson and Powell 2009, p. 349). The specific time for a Puerto Rican boa to reach sexual maturity is also unknown, but reproductive females that are older than 17 years of age have been found (Tolson 1991, p. 100).

Courtship and mating of the Puerto Rican boa is seasonal, and reproduction appears to be mostly biennial in the wild (Huff 1978, p. 96; Tolson and Henderson 1993, p. 45; Tolson 1994, p. 355). Although there can be some temporal variability in the Puerto Rican boa's reproductive activity, courtship usually starts in February and March, and mating for most Puerto Rican boas is reported to occur at the beginning of the wet season, from late April to May (Tolson and Henderson 1993, p. 45; Tolson 1994, p. 355; Puente-Rolón 2012, p. 85). Puerto Rican boas are born after a gestation period of approximately 5 to 6 months (Huff 1978, p. 97; Rivero 1998, p. 433; Puente-Rolón 2012, p. 85). Thus, the reproductive cycle of the Puerto Rican boa is synchronized with the

seasonal patterns of precipitation and temperature in Puerto Rico (Huff 1978, p. 96; Tolson and Henderson 1993, p. 45; Puente-Rolón 2012, p. 85).

The Puerto Rican boa was considered relatively rare by the 1900s (Stejneger 1904, p. 691) and is probably less abundant now than it was in Pre-Columbian times, when Puerto Rico had extensive forest cover (Reagan 1984, p. 119). However, the Puerto Rican boa is more abundant today than at the time of listing in 1970 (Service 2011, entire). This increase is probably in part due to the increase in forested areas in Puerto Rico (Lugo and Helmer 2004, p. 145; Kennaway and Helmer 2007, p. 356; Parés-Ramos et al. 2008, p. 1). In general, the species is more abundant in the karst region of northern Puerto Rico and less abundant in the dry southern region of the island (Rivero 1998, p. 433).

Recovery Criteria

Section 4(f) of the Act directs us to develop and implement recovery plans for the conservation and survival of endangered and threatened species unless we determine that such a plan will not promote the conservation of the species. Under section 4(f)(1)(B)(ii), recovery plans must, to the maximum extent practicable, include objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of section 4 of the Act, that the species be removed from the List.

Recovery plans provide a roadmap for us and our partners on methods of enhancing conservation and minimizing threats to listed species, as well as measurable criteria against which to evaluate progress towards recovery and assess the species' likely future condition. However, they are not regulatory documents and do not substitute for the determinations and promulgation of regulations required under section 4(a)(1) of the Act. A decision to revise the status of a species, or to delist a species, is ultimately based on an analysis of the best scientific and commercial data available to determine whether a

species is no longer an endangered species or a threatened species, regardless of whether that information differs from the recovery plan.

There are many paths to accomplishing recovery of a species, and recovery may be achieved without all criteria in a recovery plan being fully met. For example, one or more criteria may be exceeded while other criteria may not yet be accomplished. In that instance, we may determine that the threats are minimized sufficiently and that the species is robust enough that it no longer meets the definition of an endangered species or a threatened species. In other cases, we may discover new recovery opportunities after having finalized the recovery plan. Parties seeking to conserve the species may use these opportunities instead of methods identified in the recovery plan. Likewise, we may learn new information about the species after we finalize the recovery plan. The new information may change the extent to which existing criteria are appropriate for identifying recovery of the species. The recovery of a species is a dynamic process requiring adaptive management that may, or may not, follow all of the guidance provided in a recovery plan.

The Puerto Rican Boa Recovery Plan (recovery plan), issued by the Service on March 27, 1986 (Service 1986, entire), did not contain measurable criteria. On September 27, 2019, the Service issued an amendment to the recovery plan (Service 2019, 9 pp.) that includes delisting criteria. The following discussion provides an assessment of the delisting criteria as they relate to evaluating the status of this species.

Delisting Criterion 1

Delisting Criterion 1 reads: “At least three Puerto Rican boa populations (moist limestone (i.e., moist karst), wet limestone (i.e., wet karst), and montane forest regions) occupy at least 50 percent of the species’ suitable habitat, and populations are distributed island-wide.” The intent of this criterion is to maintain the species’ viability (resiliency, representation, redundancy) in at least 50 percent of suitable habitat throughout its range.

Although this criterion specifies having “at least three Puerto Rican boa populations,” we now consider there to be one contiguous, interbreeding, island-wide population and evaluate this criterion as such (see “Current Resiliency,” below). The current abundance estimate of between 37,903 and 189,515 boas and the density estimates of 1.2 boas per ha (2.5 ac) to 5.6 boas per ha (2.5 ac) (see “Current Resiliency,” below) were used to evaluate this criterion.

For the purposes of evaluating this criterion, we also considered both natural and developed habitat as described in the SSA report (Service 2021, p. 36), which combined three land use types with the predicted suitable habitat of the species (see “Current Resiliency,” below). Natural and developed areas include not only karst and forest habitat types, but also a broader island-wide diversity of habitats per the species’ predicted habitat model (Gould et al. 2008, p. 50; Service 2021, pp. 36–37). Habitat classifications occur within a diversity of currently occupied areas ranging from urban and densely populated landscapes to sparsely populated and rural landscapes (Gould et al. 2008, p. 50).

The current resilience evaluation used the Puerto Rico Gap Analysis Project (PRGAP) predicted habitat model (379,029 ha or 936,601 ac), of which 57 percent falls within natural habitat as described (see “Current Resiliency,” below). Natural habitats that occur within public and private protected lands are the most important areas for maintaining the species’ current and future viability. Examples of such areas include the El Yunque National Forest, Commonwealth Forests within the northern and southern karst areas, Mata de Plátano and El Tallonal Nature Reserves, and Puerto Rico Conservation Trust lands. Areas in the northern and southern karst regions are particularly important for the Puerto Rican boa and provide some of the best habitat currently occupied by the species. The Puerto Rican boa also currently occupies suitable

habitat within certain developed landscapes that provide conservation benefits as well (e.g., Fort Buchanan, Julio Enrique Monagas State Park, and Las Cabezas de San Juan).

Ultimately, the Puerto Rican boa is considered a habitat generalist and occurs within a variety of landscapes (Reynolds et al. 2016, p. 1883). Using the minimum population estimate of more than 37,000 boas island-wide, and confirmed occurrence records for the species, we consider the Puerto Rican boa to be well represented within suitable habitats across its range and conclude that the intent of this criterion has been met.

Delisting Criterion 2

Delisting Criterion 2 reads: “Populations show a stable or increasing population trend, evidenced by natural recruitment and multiple age classes.”

Multiple age classes of Puerto Rican boas have been documented indicating natural recruitment within the population (Mulero-Oliveras 2022, pers. comm.). We do not have population trend data for the Puerto Rican boa, however, the best available information indicates that the species is relatively abundant and has a broad distribution across a variety of natural and developed habitats as explained in *Delisting Criterion 1*. The species is both more abundant and widely distributed today than at the time of listing. The apparent increase in population abundance is largely attributed to the increase in forested areas in Puerto Rico (Lugo and Helmer 2004, p. 145; Kennaway and Helmer 2007, p. 356; Parés-Ramos et al. 2008, p. 1), and the designation of protected areas within habitats that Puerto Rican boas occupy (Castro-Prieto et al. 2019, p. 54). Based on this information, we consider this criterion to be met.

Delisting Criterion 3

Delisting Criterion 3 reads: “Threat reduction and management activities have been implemented to a degree that the species will remain viable for the foreseeable future.”

One of the main threats to Puerto Rican boas is habitat loss, degradation, and fragmentation. These threats can also exacerbate other threats, such as road kill and increased conflicts with humans and nonnative animals such as cats, as well as the need for management (e.g., translocations). Thus, the occurrence of Puerto Rican boas within areas designated for conservation is the most important positive influence towards the species' persistence and viability.

Puerto Rican boas occur within several protected areas (Service 2019, pp. 5–6; Service 2021, pp. 23–24). In particular, the northern karst region, which is preferred habitat for the Puerto Rican boa, consists of numerous protected areas, private lands, and Federal lands where Puerto Rican boas are known to occur. A detailed description of protected lands within Puerto Rico is provided in “Development and Habitat Protection,” below.

The Puerto Rican boa is protected under Commonwealth laws, including Law No. 241–1999 (*Nueva Ley de Vida Silvestre de Puerto Rico* (New Wildlife Law of Puerto Rico)) and Regulation 6766 or *Reglamento para Regir el Manejo de las Especies Vulnerables y en Peligro de Extinción en el Estado Libre Asociado de Puerto Rico* (Regulation 6766: To govern the management of threatened and endangered species in the Commonwealth of Puerto Rico). The purpose of Law No. 241–1999 is to protect, conserve, and enhance both native and migratory wildlife species; declare property of Puerto Rico all wildlife species within its jurisdiction; and regulate permits, hunting activities, and exotic species, among other activities. Law No. 241–1999 also prohibits the modification of natural habitat without a mitigation plan approved by the Puerto Rico Department of Natural and Environmental Resources (DNR).

Various other laws have also been approved by the Commonwealth of Puerto Rico that will continue to provide protection to the Puerto Rican boa and its habitat. Law No. 292-1999, *Ley para la Protección y Conservación de la Fisiografía Cársica*

de Puerto Rico (Puerto Rico Karst Physiographic Protection and Conservation Law), was approved in 1999 to protect karst areas as one of the most valuable natural resources of the island. This law indirectly protects the Puerto Rican boa and all other species that occur in the karst and provides for stricter land regulations to prohibit development within the Karst Restricted Zone (Castro-Prieto et al. 2019, p. 59). In addition, the Puerto Rico Conservation Trust has acquired lands for conservation within the northern and the southern karst regions of Puerto Rico, in areas where Puerto Rican boas have been confirmed (Service 2019, pp. 5–6).

The northern and the southern karst regions of Puerto Rico harbor the majority of cave formations on the island, which are essential habitat for this species. The cave populations of Puerto Rican boas are genetically diverse and represent excellent targets for conservation and for maintaining the species' genetic diversity (see “Current Representation,” below). Therefore, the conservation and protection efforts, and the corresponding reduction of the threats in lands where these formations are located, help to maintain sufficient resiliency of this species, promote its dispersion and recolonization of unoccupied habitats (representation), and improve its potential to adapt to natural and anthropogenic changes (redundancy).

As explained below in “Translocations,” the translocation of Puerto Rican boas has been implemented with varying degrees of success to avoid and minimize potential detrimental effects on the species from development and other human-boas conflicts. Because the species will continue to be protected by the DNR, pursuant to the laws and regulations discussed above, the Puerto Rican boa translocation strategies as a conservation management activity are expected to continue.

Based on our review of current local laws, regulations, and protected lands that have provided protection for the species, have helped to reduce the impact of threats, and will continue to provide benefits to the species into the foreseeable future, we

conclude that the status of the Puerto Rican boa is improved throughout its range as a result of these protections, and that this criterion has been met.

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an “endangered species” or a “threatened species”. The Act defines an “endangered species” as a species that is in danger of extinction throughout all or a significant portion of its range, and a “threatened species” as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The Act requires that we determine whether any species is an “endangered species” or a “threatened species” because of any of the following factors:

- (A) The present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) Overutilization for commercial, recreational, scientific, or educational purposes;
- (C) Disease or predation;
- (D) The inadequacy of existing regulatory mechanisms; or
- (E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species’ continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects. We consider these same five factors in delisting a species (50 CFR 424.11(c) and (e)).

We use the term “threat” to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term “threat” includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term “threat” may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an “endangered species” or a “threatened species.” In determining whether a species meets either definition, we must evaluate all identified threats by considering the species’ expected response and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an “endangered species” or a “threatened species” only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term “foreseeable future,” which appears in the statutory definition of “threatened species.” Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as we can reasonably determine that both the future threats and the species’ responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. “Reliable” does not mean “certain”; it means sufficient to

provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological review of the best scientific and commercial data regarding the status of the species, including an assessment of the potential threats to the species. The SSA report does not represent our decision on whether the species should be proposed for removal from the List ("delisted"). However, it does provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket No. FWS-R4-ES-2021-0162 on <https://www.regulations.gov> and on the Caribbean Ecological Services Field Office website at <https://www.fws.gov/southeast/caribbean/>.

To assess the Puerto Rican boa's viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (e.g., wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (e.g., droughts, large pollution events), and representation supports the ability of the species to adapt over time

to long-term changes in the environment (e.g., climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences.

Throughout all of these stages, we used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the Puerto Rican boa and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability.

Influences on Viability

Development and Habitat Protection

The Puerto Rican boa occurs on both private and public land. Puerto Rican boas that occur outside of protected habitat may be more vulnerable to deforestation and land impacts associated with commercial, industrial, highway, and urban development. In Puerto Rico, human activity has been described as "intense, pervasive, and fragments natural habitat" (Lugo and Helmer 2004, p. 156). Although forest areas have increased in

Puerto Rico, unprotected forests are vulnerable to urban development, particularly those near or within urban centers (Kennaway and Helmer 2007, p. 376). Urban growth in Puerto Rico increased at a rate of 16 percent between 2000 to 2010 (Castro-Prieto et al. 2017, p. 476). In 2007, about 5.2 percent of the island was protected (Kennaway and Helmer 2007, p. 357); this increased to 8 percent by September 2015 (Castro-Prieto et al. 2017, p. 474). By December 2016, 159 terrestrial protected areas occurred in Puerto Rico, representing 16.1 percent of the island. However, this increase largely reflected a more inclusive definition of “protected area,” extending that to the Restricted Zone within the Karst Special Planning Zone (Castro-Prieto et al. 2019, p. 54). As of December 2018, approximately 16.4 percent of terrestrial protected areas were classified as areas for conservation (Castro-Pietro et al. 2019, pp. 57–59).

Consequences of human development on Puerto Rican boa habitat include habitat loss and fragmentation as land is deforested for development (e.g., commercial, industrial, and highway development, and urbanization) and areas of suitable habitat are increasingly isolated from each other. Direct impacts on Puerto Rican boas may include harassment, harm, and mortality due to trampling with construction and vegetation clearing machinery, road kills, predation by domesticated and feral cats associated with human populations, competition with other nonnative species (i.e., *Boa constrictor*), and persecution by the public and poachers (Service 2011, pp. 12–16). As Puerto Rican boa habitat is modified and developed, it increases human-boa conflicts, thus exacerbating these direct impacts and also increasing the need to translocate Puerto Rican boas (Service 2021, pp. 26–28). These factors have the potential to impact population resiliency by affecting the species’ breeding and reproductive success and by limiting connectivity among suitable habitats.

In 1999, the Commonwealth of Puerto Rico approved Law No. 241–1999 (title 12 of the Laws of Puerto Rico Annotated (L.P.R.A.), section 107), known as *Nueva Ley de*

Vida Silvestre de Puerto Rico (New Wildlife Law of Puerto Rico); presently, the Puerto Rican boa is legally protected under this law. The purpose of this law is to protect, conserve, and enhance native and migratory wildlife species; declare as property of Puerto Rico all wildlife species within its jurisdiction; and regulate permits, hunting activities, and exotic species, among other activities. This law also has provisions to protect habitat for all wildlife species, including plants and animals. In 2004, the DNR approved Regulation 6766 or *Reglamento para Regir el Manejo de las Especies Vulnerables y en Peligro de Extinción en el Estado Libre Asociado de Puerto Rico* (Regulation 6766: To govern the management of threatened and endangered species in the Commonwealth of Puerto Rico). Law No. 241–1999 prohibits the modification of natural habitat (including Puerto Rican boa habitat) without a mitigation plan approved by the DNR (Service 2011, p. 15).

The DNR has developed similar conservation measures as provided in section 7 of the Act to avoid and minimize potential effects of development projects on the Puerto Rican boa, conservation measures are implemented with varying degrees of success and oversight (Service 2021, pp. 26–28). Because the Puerto Rican boa is a cryptic species, not all boas are likely to be detected during survey efforts, thus making it challenging to avoid or detect take of the species.

The Puerto Rican boa occurs within several protected areas, including El Yunque National Forest, the largest reserve in Puerto Rico. The Puerto Rican boa is also presumed to occur in all Commonwealth forests managed by the DNR (Rivera 2019, pers. comm.), and has been reliably confirmed to occur within the Río Abajo, Guajataca, Camabalache, Vega, and Maricao forests (Service 2021, Appendix B). The species has also been confirmed in the Guánica Commonwealth Dry Forest; however, the species is extremely rare there (Canals 2019, pers. comm.), with a single record from 1974 (Wiley 2003, p. 190) and limited fossil evidence (Pregill 1981, p. 50). This rarity is consistent

with the general description that the species is less abundant in the dry southern region of the island (Rivero 1998, p. 433).

Within the karst region of Puerto Rico, the Karst Restricted Zone (Zone) has strict land regulations (Ortíz-Maldonado et al. 2019, entire; Service 2021, Appendix B). This Zone represents 7.2 percent of the total area of Puerto Rico, includes both public and private lands, and was designated for conservation purposes by prohibiting land exploitation of any type (Castro-Prieto et al. 2019, p. 59). The Puerto Rico Conservation Trust, through its unit *Para La Naturaleza*, also manages numerous protected natural areas throughout Puerto Rico where the Puerto Rican boa has been confirmed as well: El Convento Caves, Cabezas de San Juan, Río Jacoboa, Río Encantado, Río Maricao, Hacienda La Esperanza, and Cordillera Sabana Alta (Ortíz-Maldonado et al. 2019, entire; Service 2021, Appendix B). Other protected areas that are important for the Puerto Rican boa are Julio Enrique Monagas State Park, Mata de Plátano Nature Reserve, and El Tallonal Private Reserve (managed by the nongovernmental organization, Citizens of the Karst) (Ortíz-Maldonado et al. 2019, entire; Service 2021, Appendix B). Fort Buchanan, managed by the Department of Defense, is important for the Puerto Rican boa and has an Integrated Management Resource Management Plan with an endangered species management plan to protect federally listed species in coordination with the Service and the DNR.

Since 2001, the Service's habitat restoration programs (i.e., Partners for Fish and Wildlife, and coastal programs) have been actively restoring private lands previously impacted by agricultural activities to provide suitable habitat for the Puerto Rican boa and other species within these regions.

The occurrence of Puerto Rican boas within areas designated for conservation is the most important positive influence towards the species' persistence and viability. However, even within these protected areas, Puerto Rican boas are still vulnerable to

certain risks like roadkill, intentional killings, and predation by cats, especially along the edges of forests close to human settlements. A number of studies have documented roadkill of Puerto Rican boas both within and outside El Yunque National Forest (Reagan 1984, p. 125; Wiley 2003, p. 189), with records as far back as the 1970s (Wiley 2003, pp. 191–192). Puerto Rican boa deaths associated with roads and development continue to occur today, with documentation through both social media and project consultation reports (Zegarra 2019, pers. comm.).

In summary, since its listing in 1970, there has been an island-wide increase in forested areas, directly benefiting the Puerto Rican boa by increasing available habitat. Beginning in the 1990s, numerous Federal and Commonwealth laws have been implemented that provide habitat protections in areas where Puerto Rican boas occur. Additionally, restoration of private and public lands that were historically impacted by deforestation, agricultural conversions, and other human development activities have also benefitted the species. These habitat protection and conservation measures have contributed to the current, relatively high, island-wide abundance of Puerto Rican boas.

Nonnative Species

Another risk to the Puerto Rican boa is the presence of nonnative mammalian predators, namely cats (*Felis catus*) and mongoose (*Herpestes auropunctatus*). Neonate and juvenile life stages are thought to be the most vulnerable to nonnative predators, and cats are thought to have the greatest effect since they hunt both by day and night. Puerto Rico has a pervasive and unmanaged feral cat population associated with human settlements, even occurring within protected areas like El Yunque National Forest (Engeman et al. 2006, p. 95) and Cambalache State Forest (Rodríguez-Velázquez et al. 2019, entire). Cats on islands affect native vertebrates, including reptiles such as the Jamaican boa (*Chilabothrus subflavus*; Medina et al. 2011, Appendix S1), Virgin Islands tree boa (*C. granti*), and Mona boa (*C. monensis*) (Tolson 1996, p. 409). However, there

are no specific data to accurately assess the level of impact of feral cats on the Puerto Rican boa population.

The mongoose does not appear to have seriously impacted the Puerto Rican boa population (Rivero 1998, p. 432). Although a mongoose might occasionally eat a neonate or juvenile Puerto Rican boa, studies of mongoose food habits in Puerto Rico and throughout the Caribbean have not documented any such predation (Pimentel 1955, entire; Henderson 1992, entire). Remains of a dead Puerto Rican boa were found with tooth impressions consistent with mongoose, but scavenging rather than predation was suggested (Wiley 2003, p. 193).

There is now a well-known and reproductively established population of *Boa constrictor* in Puerto Rico that likely originated near Mayagüez around the 1990s from a genetic lineage common to zoo and breeding collections (Reynolds et al. 2013, entire). This relatively recent invasion of a large snake is an emerging concern for the Puerto Rican boa. As with cats, the *Boa constrictor* has been established on Puerto Rico for several decades, but there is insufficient information to rigorously assess or measure the risks that this nonnative snake is having on the Puerto Rican boa population. Although the specific risks of this species on the Puerto Rican boa is uncertain, potential risks from this nonnative snake may include competition for food resources, displacement, and vectors for pathogens or parasites (Reed and Rodda 2009, entire). Nonnative snake species also cause public confusion between which species are in need of conservation (native snakes) and which are not (nonnative snakes). There are also several recent sightings in Puerto Rico of the larger Reticulated python (*Malayopython reticulatus*), but this invasion is apparently more recent and more restricted than the *Boa constrictor*.

Overall, nonnative species, especially predators such as cats and mongoose, may have an impact on individual Puerto Rican boas (e.g., killing or harming individuals), but the Puerto Rican boa is currently considered to have a wider distribution than when listed

and there is no information currently available to suggest that nonnative species are having a significant effect on the overall population status of the Puerto Rican boa.

Translocations

For many years, the translocation of Puerto Rican boas out of developed areas has been used as a management strategy to minimize conflicts with the public and minimize potential effects of development projects that disturb and modify Puerto Rican boa habitat. Translocations move Puerto Rican boas from areas of human-boas conflict into areas where these conflicts are potentially reduced (e.g., suitable protected Puerto Rican boa habitat away from humans). Although this strategy has been used for a long time, translocations have been poorly documented. Critical information on how many Puerto Rican boas were moved, their size classes, when and how they were moved, and where they were relocated is largely unavailable, and there is no information on the condition or the survival of these animals. In addition, Puerto Rican boas are sometimes moved to a holding facility (Puente-Rolón et al. 2013, p. 8). This has raised concerns about the impact that these practices might have on wild Puerto Rican boa populations, both in numbers being removed and the potential spread of infectious diseases (see Disease section below).

Despite poorly documented Puerto Rican boa translocation practices, research has shown that translocations can work when conducted correctly (Puente-Rolón 2012, p. 116; Puente-Rolón et al. 2013, p. 7; Mulero-Oliveras 2019, p. 69). For example, Fort Buchanan personnel maintain a record of Puerto Rican boa sightings and translocations in their facility. They developed a protocol to capture and translocate Puerto Rican boas that are found inside or around structures (houses and buildings) and construction sites. Captured Puerto Rican boas are translocated to forested areas previously identified as boa habitat within Fort Buchanan. Although some Puerto Rican boas tend to travel back to their original capture site, most boas remain within the new transfer area. Thus,

translocation strategies that consider the type and amount of habitat at release sites and the distance to the initial capture location are most successful (Puente-Rolón 2012, p. 116; Mulero-Oliveras 2019, p. 69). Fort Buchanan's management, research, and education efforts are examples of the positive influence of conservation on Puerto Rican boas. The U.S. Forest Service staff at El Yunque National Forest also successfully translocated live Puerto Rican boas within the forest (Ilse 2020, pers. comm.).

Translocations can be an effective management tool for minimizing conflict with the public and for protecting Puerto Rican boas from development and other activities.

Poaching and Intentional Killings

The hunting of Puerto Rican boas to extract their fat due to the alleged medicinal properties of the snake "oil" has been reported since the 1930s (Grant 1933, p. 225; Rivero 1998, p. 433) and was identified as a factor contributing to the species' decline (Pérez-Rivera and Vélez, Jr. 1978, p. 70). The practice of hunting Puerto Rican boas for their fat continued through the early 2000s (Reagan 1984, p. 119; Joglar 2005, pp. 162–163). In addition, one report of snake meat being used for human consumption occurred in the 1990s (Bird-Picó 1994, p. 35), and there are reports of Puerto Rican boas collected to be kept as pets (Joglar 2005, p. 146). Based on the best available information, the practice of hunting or capturing Puerto Rican boas may still occur, but probably on a limited basis as outreach and education efforts have increased.

Killing of Puerto Rican boas out of fear, religious prejudice, or ignorance may occur. However, most, if not all, of the available information on these killings is anecdotal, and there are no data to determine the level of impact this is having on the Puerto Rican boa population (Puente-Rolón and Bird-Picó 2004, p. 343; Mulero-Oliveras 2019, p. 6). In addition, development and habitat destruction may also exacerbate killing of Puerto Rican boas as it may increase human-boas interactions, especially in close proximity to prime Puerto Rican boa habitat. Even within protected habitat in El Yunque

National Forest, one Puerto Rican boa was recently found on a trail with its head chopped off (Ilse 2020, pers. comm.). Although both Federal and local laws and regulations currently prohibit the killing of Puerto Rican boas and commercial use of Puerto Rican boas, most of these cases are thought to go unreported (Service 2021, p. 28).

Hurricanes and Post-hurricane Restoration Actions

While there is scarce information on the potential direct effects of hurricanes on the Puerto Rican boa, some inferences can be drawn from the effects of recent hurricanes. After Hurricane Georges in September 1998, some Puerto Rican boas at El Yunque National Forest increased their movements and changed their habitat use, suggesting Puerto Rican boas responded as expected to hurricane alterations in forest cover and prey distribution (Wunderle et al. 2004, p. 555). Additionally, hurricane damage (i.e., loss of leaves, vines, and branches) may limit the arboreal use and movements of Puerto Rican boas (Wunderle et al. 2004, p. 569). Depending on the hurricane category and damages caused, we can expect that some Puerto Rican boas, including adult and juvenile individuals, may die due to injury from falling debris or other unknown sources. For example, the category 4 Hurricane María in September 2017 caused more than 40,000 landslides in at least 75 percent of Puerto Rico's 78 municipalities (Bessette-Kirton et al. 2019, p. 4). Such landslides may have caused the death of Puerto Rican boas in some areas.

Puerto Rican boa casualties have also been documented during post-hurricane restoration actions. Infrastructure restoration (e.g., clearing or opening new rights-of-way) and debris collection and disposal after Hurricane Maria was anticipated to cause some impacts to the Puerto Rican boa in the form of death or injury. Projects with a Federal nexus were evaluated through an emergency consultation under section 7 of the Act. Although the emergency consultation process included Puerto Rican boa conservation measures, at least four Puerto Rican boas were killed at least nine captured

and relocated during post-hurricane debris management activities. Because Puerto Rican boas are difficult to detect, we suspect that more Puerto Rican boas may have been killed during these activities. Moreover, since the emergency consultation only covered projects with a Federal nexus, it is likely that an unknown number of other hurricane-related restoration projects without Federal involvement could have negatively impacted the species.

Despite direct impacts from past and more recent hurricanes, and post-hurricane debris management on the species' habitat, the Puerto Rican boa continues to be reported throughout its range. Thus, individual Puerto Rican boas are likely impacted by hurricanes and post-hurricane restoration activities, but overall, based on the best information available, this threat does not appear to have population-level effects.

Disease

Initially observed in 2006, ophidiomycosis (formerly known as snake fungal disease and likely caused by the fungal pathogen *Ophidiomyces ophiodiicola*) was considered an emerging disease documented in both wild and captive snakes throughout most of the eastern United States by 2015 (Lorch et al. 2016, p. 2; Allender et al. 2019, p. 7). However, ophidiomycosis is now considered a widespread, previously unrecognized endemic disease (Allender et al. 2019, p. 6; Davy et al. 2021, entire). Ophidiomycosis can cause lethal infections, but multiple factors may determine impacts of ophidiomycosis on snake populations (Lorch et al. 2016, pp. 2, 6; Davy et al. 2021, p.2). Signs of ophidiomycosis include crusted, ulcerated, and discolored scales; nodules under the skin; and a swollen or disfigured face, leading to emaciation and death (Thompson et al. 2018, p. 1; McKenzie et al. 2019, p. 142). Secondary effects from the disease may include starvation, poor body condition, and bacterial infection, possibly leading to mortality (Lorch et al. 2016, pp. 4–5; McKenzie et al. 2019, p. 142). Behavioral changes in infected individuals may include abnormal or excessive molting, decrease in activity,

frequency in ecdysis (shedding of skin), and abnormal behaviors such as anorexia and basking in open and conspicuous areas which can increase the risk of mortality (Lorch et al. 2016, pp. 4–5; Thompson et al. 2018, p. 2).

In 2018, ophidiomycosis was first confirmed in Puerto Rican boas within Fort Buchanan (Allender et al. 2019, p. 20). Out of seven live Puerto Rican boas sampled, one showed clinical signs (dermal lesions) of ophidiomycosis and had a positive DNA test. Samples from three other Puerto Rican boas from Fort Buchanan showed clinical signs but had negative test results.

This disease may be underreported in populations where it affects snakes infrequently or in species that develop less severe symptoms (Thompson et al. 2018, p. 1), which may be the case for the Puerto Rican boa. Preliminary results from an ongoing study show additional positive results for at least 11 Puerto Rican boas, mostly sampled in caves (Mulero-Oliveras 2021, pers. comm.). There are also positive results for other native and nonnative snake species being sampled (i.e., *Chilabothrus granti*, *Borikenophis portoricensis*, *Boa constrictor*, *Malayopython reticulatus*).

Currently, there have been no reported fatalities of Puerto Rican boas associated with ophidiomycosis. We do not have sufficient information on the potential future spread of ophidiomycosis to reliably model this threat for forecasting future conditions for the Puerto Rican boa. However, based on the best available information, ophidiomycosis does not appear to have population-level effects on the Puerto Rican boa population, and given the lack of evidence for population level effects in other snake populations (Davy et al. 2021, p. 8), we do not consider this disease to be a primary threat to this species.

Climate Change

The Intergovernmental Panel on Climate Change (IPCC) concluded that warming of the climate system is unequivocal (IPCC 2014, p. 2). Projections for future

precipitation trends are less certain than those for temperature, but suggest that overall annual precipitation will decrease, and that tropical storms will occur less frequently, but with more force (more category 4 and 5 hurricanes) than historical averages (Knutson et al. 2010, entire; Carter et al. 2014, entire). These predictions are consistent with the predicted scenario of a gradual trend towards a drier and hotter climate for Puerto Rico (Khalyani et al. 2016, entire; Bhardwaj et al. 2018, entire).

The Puerto Rican boa's reproductive cycle is synchronized with seasonal patterns of precipitation and temperature (Huff 1978, p. 96; Tolson and Henderson 1993, p. 45; Puente-Rolón 2012, p. 85), and climate variations may affect availability of prey such as rats (Puente-Rolón 2012, p. 89). Thus, climate change may alter certain critical aspects of the biology of the Puerto Rican boa, potentially shifting the reproductive activity of adults and reducing fitness. Puerto Rican boa habitat is also expected to change with the predicted shifts in life zones, as rain, wet, and moist zones gradually become drier (Khalyani et al. 2016, p. 265). This shift would potentially reduce the amount of available suitable habitat for the Puerto Rican boa. In general, all habitats are susceptible to one or more climate change stressors, such as sea level rise, increased severity of storms (i.e., hurricanes), increased droughts, and higher temperatures (Puerto Rico Climate Change Council (PRCCC) Working Group 2 2013, pp. 157–168).

Species that are dependent on specialized habitat types, limited in distribution, or at the extreme periphery of their range are most susceptible to the impacts of climate change (Byers and Norris 2011, p. 22). However, none of these conditions applies to the Puerto Rican boa, which is a habitat generalist (Reynolds et al. 2016, p. 1883) and has an island-wide distribution. However, several potential mechanisms for climate change impacts have been suggested, including increased physiological stress on the Puerto Rican boa and exacerbation of the species' response to pathogenic infections (PRCCC Working Group 2 2013, p. 162). Climate change may also affect the species' dispersal

behavior, increase its feeding frequency, reduce the availability of prey, and increase water loss, further affecting the survival of the Puerto Rican boa (PRCCC Working Group 2 2013, p. 162). Lastly, although sea level rise is not specifically mentioned as a potential threat to the Puerto Rican boa (PRCCC Working Group 2 2013, p. 164), we expect sea level rise to reduce available coastal habitat. Sea level rise projections for Puerto Rico are between 0.4 m (1.3 ft) and 1.0 m (3.2 ft) by the year 2100 (PRCCC Working Group 2 2013, p. 67) and could reduce or degrade habitat within coastal mangrove forests. However, because the Puerto Rican boa is a habitat generalist, we do not expect the potential loss of coastal habitat to sea level rise, to have population-level effects.

In summary, climate change may cause changes in some of the Puerto Rican boa's life-history strategies (e.g., timing of reproduction), or it may impact habitats that Puerto Rican boas use (e.g., coastal habitats), but overall, because the Puerto Rican boa is a habitat generalist, and based on the best information currently available, we do not anticipate that climate change will have population-level effects on the species in the foreseeable future.

Current Condition

A more recent study within the urban landscape of Fort Buchanan documented a total of 50 live and 9 dead Puerto Rican boas from 2013 to 2017 (Mulero-Oliveras 2019, p. 23). Thirty-eight of the live individuals were used for the per person-hour estimate of the Puerto Rican boa population in Fort Buchanan, resulting in a general population density of 1.2 boas per ha (2.5 ac), as well as 3.8 boas per ha (2.5 ac) within one karst forest fragment, considered a Puerto Rican boa hot spot within Fort Buchanan (Mulero-Oliveras 2019, p. 24).

Current Resiliency

Based on the available information, including input from species experts, we determined there is one island-wide Puerto Rican boa population (Service 2021, pp. 34–35). This population may function as several interbreeding groups, which are concentrated within certain habitat patches or landscapes that may or may not interact at different levels via natural or human-facilitated dispersal. The Puerto Rican boa is characterized as a homogenous population with relatively high genetic diversity (Puente-Rolón et al. 2013, entire; Service 2021, pp. 34–35). For the Puerto Rican boa to maintain its viability, its population must be able to withstand stochastic events (demographic, environmental, and anthropogenic). To maintain resiliency to stochastic events, this species needs an adequate number of individuals (abundance) from all life stages (breeding adults, juveniles, and hatchlings).

Prior to Puerto Rico’s historical deforestation, the Puerto Rican boa probably occurred in almost all habitats below 500 m (1,640 ft) elevation (Puente-Rolón et al. 2013, p. 7). Based on current abundance estimates, it was recently suggested that the Puerto Rican boa “is widely considered to have recovered from the near-complete deforestation of the island of Puerto Rico in the early 20th century” (Reynolds and Henderson 2018, p. 13). This assessment suggests that the Puerto Rican boa population is able to withstand certain levels of natural and anthropogenic disturbances through long periods of time. Puerto Rican boa populations can persist in urban fragmented landscapes in low densities, but not without certain costs (e.g., smaller home range sizes, lower abundance, and greater exposure to threats) (Mulero-Oliveras 2019, pp. 58–59).

We assessed the population’s resiliency by using the available density estimates of 1.2 boas per ha (2.5 ac) to 5.6 boas per ha (2.5 ac) in combination with the species’ PRGAP predicted habitat model to calculate a rough estimate of the Puerto Rican boa’s population size (Gould et al. 2008, pp. 49–50; Service 2021, pp. 14–15, Appendix A–2). The PRGAP predicted an estimated 414,379 ha (1,023,952 ac) of Puerto Rican boa

habitat, that is, 46.3 percent of the island from sea level to 1,000 m (3,281 ft) (Gould et al. 2008, p. 50; Service 2021, pp. 14–15, Appendix A–2). We used this as our baseline model to assess the variability of the current quality of habitats available for the Puerto Rican boa across the island. Because there are no clear records of Puerto Rican boas above 700 m (2,297 ft), we refined the PRGAP model to consider only areas below 700 m (2,297 ft) as predicted suitable habitat, resulting in an estimated 379,029 ha (936,601 ac) of predicted Puerto Rican boa habitat.

Based on the analysis in the SSA, population abundance ranges from 37,903 to 189,515 boas (i.e., 0.1 boas per ha (2.5 ac) and 0.5 boa per ha (2.5 ac), as multiplied by 379,029 ha (936,601 ac) of Puerto Rican boa suitable habitat for the entire island) (Service 2021, p.37). Because Puerto Rican boas occur in higher densities in some areas, 37,903 can be viewed as the lower bound of the current population estimate for Puerto Rican boas in Puerto Rico.

Using the lower bound population estimate combined with the species' known high adult survival rate (greater than 90 percent), we consider the Puerto Rican boa population to have a medium to high level of resiliency (Service 2021, pp. 37–38). That is, the Puerto Rican boa population has a medium to high ability to withstand stochastic events (demographic, environmental, and anthropogenic). We also assume that the most resilient interbreeding groups occur where suitable habitat and resources are least fragmented, occur the farthest from human settlements, and occur where nonnative predators are few or absent, which are reasonable assumptions given our understanding of the ecology of the species.

Current Redundancy

High redundancy reduces the species' extinction risk in the event a portion of the species' range is negatively affected by a natural or anthropogenic catastrophic disturbance. For the Puerto Rican boa to withstand catastrophic events such as

hurricanes, it needs to maintain sufficient resiliency across its range. Thus, we used the geographic distribution from the PRGAP predicted potential habitat model to assess redundancy. The exact historical distribution of the Puerto Rican boa is unknown, but its present, seemingly fragmented, distribution suggests that it occupied more areas than its current range. The current range likely reflects localized extirpations due to habitat degradation and human persecution.

The Puerto Rican boa has a wide distribution across Puerto Rico, and the presence of suitable habitat throughout its range reduces the risk that any large portion of the species' range will be negatively affected by a single catastrophic or anthropogenic event at any one time, except for hurricanes, which can have island-wide effects. Given the amount of suitable habitat available for the Puerto Rican boa (Service 2021, p. 37), the species appears to be well-buffered against the effects of catastrophic events.

Catastrophic events that could affect Puerto Rican boa habitat include, but are not limited to, hurricanes and the emergence of new threats, like snake fungal diseases (see *Influences on Viability*, above). During Hurricane Maria in 2017, the entire range of the Puerto Rican boa was subject to hurricane force winds (greater than 64 knots (74 miles per hour)) as the mostly Category 4 hurricane passed over the Puerto Rico mainland. Despite direct impacts from past and more recent hurricanes, and post-hurricane debris management of the species' habitat, the Puerto Rican boa continues to be reported throughout its range (Service 2021, Appendix C). Thus, we do not consider hurricanes to be a threat to the species.

In summary, the current redundancy for the Puerto Rican boa is characterized by one island-wide population with a medium to high level of resiliency across most of the species' historical range, although the current distribution is likely fragmented due to habitat degradation.

Current Representation

Representation describes the ability of a species to adapt to changing environmental conditions over time and is characterized by the genetic structure of the species and the environmental diversity within and among populations (Service 2016, p. 10). The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or anthropogenic) in its environment. Thus, to evaluate representation for the Puerto Rican boa, we used the available species-specific genetic information. In addition, we considered the ecological variability of habitats used by the Puerto Rican boa.

Genetic assessments of the Puerto Rican boa demonstrate a relatively high level of genetic diversity. Based on 86 samples from 15 municipalities in Puerto Rico, three clear haplogroups and no distinct phylogeographic structure across the island were identified, indicating a relatively high level of genetic diversity within the areas sampled and an overall high haplotype diversity (Puente-Rolón et al. 2013, p. 7). Although Puerto Rican boas inhabiting caves are not genetically different from Puerto Rican boas that occur in other habitats, they harbor multiple genetic lineages and represent a large proportion of the genetic diversity of Puerto Rican boas (Puente-Rolón et al. 2013, p. 5; Reynolds and Puente-Rolón 2014, p. 1). Additionally, genetic analyses from at least one location in the north (municipality of Dorado) are indicative of reduced gene flow and genetic drift, potentially due to habitat fragmentation or isolation that is affecting the species' ability to naturally disperse (Puente-Rolón et al. 2013, p. 6).

The available genetic studies have not indicated that critical genetic differences currently exist across the range of the Puerto Rican boa (Puente-Rolón et al. 2013, entire). In addition, there is no evidence that any genetic abnormalities have emerged or that overall fitness of the Puerto Rican boa population has decreased. The best available science indicates that the Puerto Rican boa population seems well represented with relatively high genetic diversity.

Current Condition Summary

The Puerto Rican boa population exhibits medium to high resiliency and has an estimated island-wide current population of approximately 37,903 to 189,515 boas, with density estimates that range from 1.2 boas per ha (2.5 ac) to 5.6 boas per ha (2.5 ac). Given the amount of predicted habitat and the medium to high resiliency across its range, the Puerto Rican boa population appears to have adequate redundancy and seems well buffered against catastrophic events. We determined the Puerto Rican boa is well represented, with an overall high level of genetic diversity over relatively broad and diverse geographic areas.

Projected Future Status

To assess the future viability of the Puerto Rican boa, we used a demographic matrix model and projected the overall population response to four different habitat change scenarios 30 years into the future (2050). We predicted resilience at 30 years into the future (year 2050) considering input from species experts and the information available to reasonably predict development changes in threats, and the species' response to these changes. This timeframe reflects more than one generation of Puerto Rican boas, which may live more than 20 years (Rivero 1998, p. 433; Henderson and Powell 2009, p. 349).

These four scenarios provide a range of viability predictions for the species and are intended to represent Puerto Rican boa population response to the key threats of habitat loss, habitat fragmentation, and human interactions. These habitat and human-associated influences can be related to increased development, conversion of natural areas to urban areas for residential and commercial development, and road construction and expansion. Human-caused habitat loss can also be related to other threats such as increased human-boa conflicts, intentional killings, and predation by cats. We do not explicitly include in our scenarios the impacts of hurricanes, diseases, or climate change

on Puerto Rican boas or their habitat. Information available for these threats is lacking or the response of Puerto Rican boas to these threats is unknown.

To project Puerto Rican boa population size into the future based on different amounts of development, we used a stage-based Lefkovitch matrix model (Caswell 2001, pp. 56–109; Tucker et al. 2020, p. 2; Service 2021, pp. 43–45). This model allows us to account for stage-specific differences in survival and reproductive output into the future. We considered four life stages based on size: young (less than 60 cm (2 ft)), juveniles (60–90 cm (2–3 ft)), subadults (90–110 cm (3–3.6 ft)), and adults (greater than 110 cm (3.6 ft)). We elicited the probabilities of annual survival, growth to the next size class, and fecundity (average number of offspring per individual) for each size class from the Puerto Rican boa expert team or drew values from the available literature (Tucker et al. 2020, p. 3; Service 2021, pp. 19, 43–45). Personal information, unpublished data, and inference from captive zoo populations was used by the expert team to determine productivity and survival rates. For more details on the model, please see Tucker et al. (2020, entire) and the SSA report (Service 2021, pp. 43–49).

We considered future scenarios that included changes in land cover such that developed areas would encroach upon natural areas, resulting in both an increased proximity of development to natural areas and loss of overall Puerto Rican boa habitat. With these scenarios, we also sought to indirectly capture key threats due to habitat loss and increased conflicts with humans and cats. Some Puerto Rican boa populations can coexist with development when suitable habitat and prey are available within a managed urbanized matrix like Fort Buchanan, but not in a purely developed landscape (Mulero-Oliveras 2019, p. 35).

The four future scenarios were based on an analysis of past rates of urbanization in proximity to protected natural areas in Puerto Rico, which found that urban growth increased at a rate of 16 percent over a decade (years 2000–2010) (Castro-Prieto et al.

2017, p. 476). One of the scenarios includes projected the status quo urbanization rate, while the other three scenarios include different changes in urbanization rate (described below). Urbanization rate was defined as the rate at which both overall suitable Puerto Rican boa habitat declined and the rate at which the percent of available habitat that fell within developed areas increased (Service 2021, pp. 49–50). By simulating simultaneous habitat loss and land cover change, these scenarios represent the most intense impacts of urbanization on Puerto Rican boa populations.

The four potential future scenarios are described as follows: no further urbanization (0 percent), reduced urbanization (8 percent), status quo urbanization (16 percent), and increased urbanization (24 percent) (see table 1, below; Tucker et al. 2020, entire). Under the “best-case” scenario of no future urban growth, the proportion of Puerto Rican boa habitat in natural and urban areas would remain the same as current condition (estimated at 43 percent), and the total amount of habitat would remain constant (see table 1, below). Under the “reduced urbanization” scenario, we assumed an 8 percent increase in urbanization per decade, with both the proportion of Puerto Rican boa habitat falling in an urban matrix increasing by 8 percent every 10 years and the total Puerto Rican boa habitat area decreasing by 8 percent every 10 years (see table 1, below). The third “status quo” scenario assumes the rate of urbanization continues at 16 percent per decade, and the total amount of available Puerto Rican boa habitat would likewise decrease by 16 percent every 10 years (see table 1, below). The fourth, “worst-case” scenario assumes that the rate of urbanization would increase to a rate of 24 percent per decade (see table 1, below), with all the associated impacts to Puerto Rican boa habitat realized. To implement all scenarios in the model, we calculated the expected rate of development per year and used this to calculate the predicted total Puerto Rican boa habitat availability and proportion in urban areas. This assumes that development occurs

gradually each year and is based on analysis conducted by Castro-Prieto et al. (2017, entire).

Table 1. Total Puerto Rican boa habitat area and proportion of habitat falling within an urban area in 30 years under four potential rates of urban growth. The total habitat available in a given year (hab_t) is found by $hab_t = hab_{t-1} - r * hab_{t-1}$ and the percent developed habitat (dev_t) is given by $dev_t = dev_{t-1} + r * dev_{t-1}$, where r is the yearly rate of urbanization (Table data from Tucker et al. 2020, entire).

Scenario	Urban growth per decade	Total habitat area in 30 years in hectares (acres)	Developed habitat in 30 years	Total natural habitat in 30 years in hectares (acres)	Total developed habitat in 30 years in hectares (acres)	Total habitat area lost in hectares (acres)
1. No further urbanization	0 percent	379,029 (936,601)	43 percent	215,046 (531,390)	163,983 (405,210)	0
2. Reduced urbanization	8 percent	300,269 (741,980)	54 percent	138,124 (341,311)	162,145 (400,669)	78,760 (194,620)
3. Status quo	16 percent	237,427 (586,694)	68 percent	75,977 (187,743)	161,450 (398,951)	141,602 (349,906)
4. Increased urbanization	24 percent	187,377 (463,018)	86 percent	25,233 (62,352)	162,144 (400,666)	191,652 (473,582)

We used a stochastic simulation model to assess the future condition of Puerto Rican boas under different rates of urbanization (Tucker et al. 2020, pp. 5–6; Service 2021, pp. 51–52). We projected each population for 30 years, starting in the stable stage distribution (calculated from the average demographic matrix). For more details on the projected population model, please see Tucker et al. (2020, entire) and the SSA report (Service 2021, pp. 51–55, Appendix F).

Quasi-extinction risk was used as a measure for future resilience under the different scenarios. Many population viability analyses use a quasi-extinction threshold to assess extinction risk. The quasi-extinction threshold is the population size below which either the population cannot recover because it enters an “extinction vortex” (Gilpin and Soulé 1986, pp. 19–34), or the plausible management alternatives would drastically change (e.g., switching from habitat management to captive breeding).

Selecting an appropriate quasi-extinction threshold for a specific population is often challenging due to uncertainties about both how demographic feedbacks and management actions influence realized population dynamics. Therefore, we assessed quasi-extinction risk at four thresholds, chosen to demonstrate the sensitivity of the results to quasi-extinction threshold levels: total population size of 50, 500, 1,000, or 5,000 (Service 2021, p. 53, Appendix E). For each scenario, we calculated the probability of the population falling below these thresholds as the proportion of replicates in which this occurred.

Our projection model indicated that the Puerto Rican boa population is most likely to decline over a 30-year period under all scenarios except the zero percent urbanization scenario (see table 2, below). However, in all scenarios, the rates of decline are low; even under the worst-case scenario, the population growth rate was 0.98. Quasi-extinction probability within 30 years was 0 for all scenarios for thresholds less than 1,000. Under the worst-case scenario and a population threshold of 5,000, the quasi-extinction probability was only 0.015 (see table 2, below) (Tucker et al. 2020, pp. 6–9; Service 2021, pp. 55–56). These low probabilities of quasi-extinction indicate that the species is resilient to the future development even in the worst-case scenario.

Table 2. The probabilities of quasi-extinction, population growth, and population decline for each scenario. The probability of population growth and decline are the proportion of replicates in which the average population growth rate (λ) was greater than 1.0 or less than 1.0, respectively. Average population growth rate is presented as the median, and 95 percent quantiles are included in parentheses. (Table from Tucker et al. 2020, p. 8).

Scenario	Urban growth per decade	Quasi-extinction probability				Probability of population stability or growth	Probability of population decline	Average population growth rate (95 percent quantiles)
		50	500	1,000	5,000			

1. No further urbanization	0 percent	0	0	0	0.005	0.502	0.499	1.0 (0.933, 1.06)
2. Reduced urbanization	8 percent	0	0	0	0.006	0.435	0.565	0.994 (0.927, 1.06)
3. Status quo	16 percent	0	0	0	0.011	0.357	0.643	0.987 (0.921, 1.05)
4. Increased urbanization	24 percent	0	0	0	0.015	0.285	0.715	0.98 (0.916, 1.04)

Summary of Future Condition Analysis

We characterized resiliency, redundancy, and representation in the future based on interpretation of the current condition versus the population projection results and predicted quasi-extinction probabilities. Based on the results under the status quo scenario, we expect resiliency to be slightly lower (medium) than the current condition (high to medium) in the foreseeable future (year 2050), especially if we consider all factors that may influence resilience (e.g., development and protection). Possible changes to resiliency are expected to be related to parameters such as habitat quality and quantity, and both of those are expected to deteriorate with time, more so at the edges and outside of protected habitat. We do not expect changes to redundancy and representation since the single Puerto Rican boa population would likely continue to occur across its range.

Quasi-extinction probabilities were low for all scenarios. The large initial population size (roughly estimated at 37,903 to 189,515 individuals) likely buffers the Puerto Rican boa population from falling below the quasi-extinction thresholds, and if current population size is lower than our projected minimum of 37,903, quasi-extinction probability may be greater (Tucker et al. 2020, p. 7). However, as stated above under “Current Resiliency,” this minimum population size estimate is likely an underestimate given the assumptions used to derive it.

We conclude it is reasonable to assume that the status quo scenario (16 percent rate of urbanization per decade) will continue, regardless of growth or decline in the overall human population, as residential construction in natural areas is expected to continue (Castro-Prieto et al. 2017, p. 474). Although the status quo scenario was more likely to result in population declines (64.3 percent) than in population stability or growth (35.7 percent), the projections also demonstrate that the decline under this scenario would be slight, with a very low probability of abundance reaching 5,000 individuals or fewer (see table 2, above) (Service 2021, p. 55; Tucker et al. 2020, p.8). Because population size is not expected to decline substantially into the foreseeable future, neither is the viability of the species as a whole within a 30-year timeframe.

With a continued increase in the urban landscape representing status quo growth, we may expect the Puerto Rican boa's density and distribution to slowly decline. This may be exacerbated by other influences on viability, such as exposure to cats, intentional killings, and road kill. Habitat fragmentation may also increase, and this may reduce gene flow locally within highly urbanized areas. Furthermore, lands around protected areas in Puerto Rico are vulnerable to development (Castro-Prieto et al. 2017, p. 478). This is reflected in the higher probability of declines, even under the reduced urbanization scenario (8 percent per decade) (see table 2, above), although the magnitude of these declines is slight.

Collectively, these results emphasize the import role that habitat protection is playing in the current and future status of the Puerto Rican boa. Caves contain some of the most important habitats for the Puerto Rican boa (Puente-Rolón et al. 2013, entire) and are broadly covered under the Karst Conservation Zone (PRPB and DNER 2014, p. 1; Service 2021, p. 40), as described above under "Development and Habitat Protection," and *Delisting Criterion 3*.

There are some unique urban and highly modified landscapes like Fort Buchanan where the Puerto Rican boa has been found at moderate densities (between 1.2 and 3.8 boas per ha) or more than 30 years (Pérez and Vélez, Jr. 1978, p. 71), which represents lower densities than in less modified landscapes (Mulero-Oliveras 2019, p. 24). The Fort Buchanan population is an example of how the species has responded to threats to its viability. Maintaining remnant forest fragments within the Fort Buchanan area has proved vital for the Puerto Rican boa's conservation, but it has also benefited from management efforts from the Fort Buchanan staff and cooperators.

Based on all of the above information, we anticipate the Puerto Rican boa population to largely maintain current numbers with small declines occurring as habitat degradation and fragmentation increase and development encroaches into suitable areas. The current condition of the Puerto Rican boa population is encouraging, particularly when compared to the available information when the species was listed.

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. To assess the current and future condition of the species, we undertake an iterative analysis that encompasses and incorporates the threats individually and then accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Determination of the Puerto Rican Boa's Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of an endangered species or a threatened species. The Act defines an “endangered species” as a species that is in danger of extinction throughout all or a significant portion of its range, and a “threatened species” as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. For a more detailed discussion on the factors considered when determining whether a species meets the definition of an endangered species or a threatened species and our analysis on how we determine the foreseeable future in making these decisions, please see **Regulatory and Analytical Framework**, above.

Status Throughout All of the Puerto Rican boa's Range

In 1970, the Puerto Rican boa was listed as endangered under the Endangered Species Conservation Act of 1969, due to apparent declines in both population size and distribution associated with the widespread deforestation of Puerto Rico in the 1800s (35 FR 16047, October 13, 1970; Service 1986, p. 7). After evaluating threats to the species and assessing the cumulative effects of the threats under the Act's section 4(a)(1) factors, we find that, while the present or threatened destruction, modification, or curtailment of its habitat (Factor A) remains the primary stressor for the species, the species is not currently at risk of extinction now throughout all of its range. The species has demonstrated resiliency and the ability to recover from human and natural disturbances, including catastrophic events such as hurricanes. Additionally, the Puerto Rican boa has increased in abundance since the time of listing, and conservation efforts continue to benefit the species, particularly in protected areas where Puerto Rican boas occur. Therefore, we expect the species' relatively medium to high population resiliency to continue to ameliorate this threat in the foreseeable future.

The Puerto Rican boa has shown an ability to adapt to changing environmental conditions caused by both human (e.g., development) and natural disturbances (e.g., hurricanes). Past, current, and expanding urban development will continue to impact the Puerto Rican boa; however, the projected population declines will be slight and well above levels that would be at risk of extinction. When suitable habitat and resources are present, the Puerto Rican boa has demonstrated a medium to high level of resiliency (with a current estimated population abundance between 37,903 and 189,515 boas, and an island-wide density estimate of 1.2 boas per ha (2.5 ac) to 5.6 boas per ha (2.5 ac)) in its current ability to maintain viability in spite of these threats. The species' representation is ensured by its relatively high genetic diversity and its continued occurrence within varied habitat types, as well as its relatively high abundance and broad distribution throughout its island-wide range (redundancy). Ongoing efforts to preserve optimal habitats, notably caves in the northern karst region where the highest genetic diversity exists, are highly beneficial to Puerto Rican boa conservation.

At the time of listing, the Puerto Rican boa's population size was unknown, but the species was considered to be rare. Now, we estimate that between 37,903 and 189,515 Puerto Rican boas may occur island-wide. Although this estimate is considered a rough population estimate, the best available information indicates that the Puerto Rican boa is likely more abundant today than at the time of listing. Given the demonstrated resilience of the Puerto Rican boa to historical habitat loss and fragmentation, the present threat of development (Factor A) and the newer threats of nonnative species and disease do not put the species at risk of extinction now. Hurricanes (Factor E) have the potential to negatively impact the Puerto Rican boa directly through mortality and habitat destruction, and indirectly through post-hurricane restoration activities. However, even after recent severe hurricanes (e.g., Hurricane Maria in 2017), the species demonstrated the ability to recover from these natural disturbances.

Therefore, we find that habitat loss, nonnative species, disease and hurricanes are not currently having population-level impacts on the species.

To more closely examine the future threat posed by habitat loss and habitat fragmentation, we projected four different development (or urbanization) scenarios 30 years into the future (2050). The model estimated a very low probability of significant decline within 30 years and a less than 2 percent probability of reaching quasi-extinction (5,000 individuals or fewer) under all four scenarios of future urbanization (Service 2021, p. 55). Because population size is projected to only decrease slightly in the foreseeable future, the species is not likely to become an endangered species within the next 30 years. Therefore, after assessing the best available data, we conclude that the Puerto Rican boa is not in danger of extinction now (i.e., does not meet the Act's definition of an "endangered species") nor is it likely to become so within the foreseeable future (i.e., does not meet the Act's definition of a "threatened species") throughout all of its range.

Status Throughout a Significant Portion of Its Range

Under the Act and its implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. Having determined that the Puerto Rican boa is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the species' range for which it is true that both (1) the portion is significant; and (2) the species is in danger of extinction now or likely to become so in the foreseeable future in that portion. Depending on the case, it might be more efficient for us to address either the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not

need to evaluate the other question for that portion of the species' range.

In undertaking this analysis for the Puerto Rican boa, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the species is endangered or threatened. We considered whether any of the threats acting on the Puerto Rican boa are geographically concentrated in any portion of the species' range at a biologically meaningful scale.

The primary threats to the species include development and habitat loss, nonnative predators, and public attitudes towards snakes. The Puerto Rican boa functions as a single, contiguous population and occurs island-wide. Puerto Rican boas occur on both privately and publicly owned land, and impacts from human development and habitat loss are prevalent throughout the species' range. Introduced predators, especially feral cats, occur rangewide. Similarly, the intentional killing of Puerto Rican boas can occur anywhere throughout the range when humans encounter boas. While Puerto Rican boas that live in proximity to developed areas are more susceptible to intentional killings, public fear towards snakes is a threat that can impact Puerto Rican boas throughout their range. Therefore, we conclude that none of these threats are concentrated in any particular portion of the species' range so as to affect the representation, redundancy, or resiliency of the species.

We found no concentration of threats in any portion of the Puerto Rican boa's range at a biologically meaningful scale. Therefore, no portion of the species' range can provide a basis for determining that the species is in danger of extinction now or likely to become so in the foreseeable future throughout a significant portion of its range, and we find the species is not in danger of extinction now or likely to become so in the foreseeable future in any significant portion of its range. This does not conflict with the courts' holdings in *Desert Survivors v. U.S. Department of the Interior*, 321 F. Supp. 3d

1011, 1070-74 (N.D. Cal. 2018) and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d 946, 959 (D. Ariz. 2017).

Determination of Status

Our review of the best available information indicates that the Puerto Rican boa does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. Therefore, we propose to remove this species from the Federal List of Endangered and Threatened Wildlife.

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.11(h) to remove the Puerto Rican boa from the Federal List of Endangered and Threatened Wildlife. The prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, would no longer apply to this species. Federal agencies would no longer be required to consult with the Service under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect the Puerto Rican boa. There is no critical habitat designated for this species.

Post-delisting Monitoring

Section 4(g)(1) of the Act requires us, in cooperation with the States, to implement a monitoring program for not less than 5 years for all species that have been delisted due to recovery. Post-delisting monitoring (PDM) refers to activities undertaken to verify that a species delisted due to recovery remains secure from the risk of extinction after the protections of the Act no longer apply. The primary goal of PDM is to monitor the species to ensure that its status does not deteriorate, and if a decline is detected, to take measures to halt the decline so that proposing it as endangered or threatened is not again needed. If at any time during the monitoring period data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing.

We are proposing to delist the Puerto Rican boa based on our analysis in the SSA report, expert opinions, and as conservation and recovery actions taken. Since delisting would be, in part, due to conservation actions taken by partners, we have prepared a draft post-delisting monitoring (PDM) plan for the Puerto Rican boa. The draft PDM plan discusses the current status of the taxon and describes the methods proposed for monitoring if we delist the taxon. The draft PDM plan: (1) Summarizes the status of the Puerto Rican boa at the time of proposed delisting; (2) describes frequency and duration of monitoring; (3) discusses monitoring methods and potential sampling regimes; (4) defines what potential triggers will be evaluated to address the need for additional monitoring; (5) outlines reporting requirements and procedures; (6) proposes a schedule for implementing the PDM plan; and (7) defines responsibilities. It is our intent to work with our partners towards maintaining the recovered status of the Puerto Rican boa. We appreciate any information on what should be included in post-delisting monitoring strategies for this species (see **Information Requested**, above).

Required Determinations

Clarity of the Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

- (1) Be logically organized;
- (2) Use the active voice to address readers directly;
- (3) Use clear language rather than jargon;
- (4) Be divided into short sections and sentences; and
- (5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments

should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), need not be prepared in connection with determining a species' listing status under the Endangered Species Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with Tribes in developing programs for healthy ecosystems, to acknowledge that Tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to Tribes. We have determined that there are no Tribal interests affected by this proposal.

References Cited

A complete list of references cited in this rulemaking is available on the internet at <https://www.regulations.gov> and upon request from the Caribbean Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the Fish and Wildlife Service's Species Assessment Team and the Caribbean Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Plants, Reporting and recordkeeping requirements, Transportation, Wildlife.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.11 [Amended]

2. Amend § 17.11, in paragraph (h), by removing the entry for “Boa, Puerto Rican” under REPTILES in the List of Endangered and Threatened Wildlife.

Martha Williams,
Director,
U.S. Fish and Wildlife Service.

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